

DISCUSSION OF THE AMENDMENT

Claims 1-22 are pending.

Claims 1-2, 4, 6-11, 15-16, and 18-19 are amended in order to improve readability.

No new matter is believed to be added upon entry of the amendment.

Upon entry of the amendment, Claims 1-22 remain pending.

REMARKS

The rejections of Claims 1-22 under:

- (1) 35 U.S.C. § 103(a) over the combined disclosures of U.S. Patent Application publication 2004/0077906 (US '906) and U.S. Patent No. 6,133,487 (US '487) and
- (2) the judicially created doctrine of obviousness-type double patenting over the combination of Claims 1-23 of U.S. Patent Application No. 10/683,403 (US '403) and US '487

are respectfully traversed.

It is noted that US '403 published as US '906 on April 22, 2004, and issued as U.S. Patent No. 6,936,738 (US '738) on August 30, 2005. For the sake of convenience, the following discussion will refer to the disclosure and claims of US '738.

First, in order to better distinguish the present invention with respect to the cited documents, the Applicants would like to point out the object of the present invention.

The present invention concerns a process for the continuous preparation of phenol based on the direct oxidation of benzene with hydrogen peroxide.

The process is carried out in a triphase reaction system comprising a first liquid phase consisting of benzene and an organic solvent, a second liquid phase consisting of water and a solid phase consisting of a catalyst based on titanium silicalite TS-1, working with a ratio H₂O₂/benzene in an amount that ranges from 10 to 70%.

The obtained by-products (benzenediols) are transformed into phenol through hydrodeoxygenation with hydrogen and are then recycled to the distillation section.

Many processes are known for preparing phenol, which entails the direct oxidation of benzene with hydrogen peroxide, in presence of active catalytic systems.

Such processes are usually carried out in an organic solvent able to improve the contact between the organic substrate and hydrogen peroxide.

For example in US '487 discloses the use of a specific solvent as sulpholane to obtain significant improvements of conversion and selectivity of the process.

However, working in presence of a specific solvent and in a triphase system, no high productivity is obtained.

This is due to the fact that the process must be carried out at low benzene conversions in order to limit the reactions of consecutive oxidations of phenol to by-products (cathecol and hydroquinone).

The technical problem that the present invention addresses is that of improving the process productivity, eliminating the co-production of diphenols and saving on the costs of disposing of any by-products.

This problem has been solved through the development of a process which discloses the integration of the process of synthesis of phenol through direct oxidation of benzene with hydrogen peroxide, with a hydrodeoxygenation section of by-products, cathecol and hydroquinone, which are selectively transformed to phenol and recycled to the distillation section.

The hydrodeoxygenation of cathecol and hydroquinone is disclosed in US '738. However, the process of the application at issue is not the result of the simple integration of two processes.

It is pointed out, for example, that the phenol synthesis is carried out under particular working conditions which are not disclosed or suggested in the combined disclosures of US '738 and US '487.

Further these prior documents do not consider the problem of improving the productivity through the integration of the two processes above considered.

The process according to the present application, for example, works in a range of molar ratio H₂O₂/benzene wider than that which is disclosed in the references at issue. Under these conditions there occurs a greater formation of by-products that, in the case of the present invention, are anyway converted to phenol in the section of hydrodeoxygenation, allowing therefore to reach high conversions to benzene and high productivity.

From a practical point of view, the advantages which are obtained working according to the process of the present invention are the following:

increase of productivity of the process which can reach up to 159 g of phenol/litre of reaction mixture (see i.e. example 8 of the present application), with a following reduction of the amount of solvents to be recycled (5.3 kg per kg of phenol) and of the costs for dimensioning the industrial plant (with regard to the recovery section);

elimination of the diphenols co-production (the final selectivity to phenol, after the by-products recovery, is equal to 99%); and

saving on the costs of disposing of the by-products.

In view of the above-stated considerations, it is believed that the claimed process is unobvious over the combined disclosures or disclosures and claims of US '738 and US '487. It is respectfully requested that the Examiner acknowledge the same and withdraw these rejections.

Applicants believe that the present application is in a condition for allowance. Should the Examiner deem that a personal or telephonic interview would be helpful in advancing this application toward allowance, he is encouraged to contact Applicants' undersigned representative at the below-listed telephone number.

Application No. 10/716,460
Reply to Office Action of April 21, 2005

The shortened statutory due date for the April 21, 2005 Office Action was July 21, 2005. Applicants file concurrently herewith a request for extension of time under 37 CFR § 1.136, with the appropriate fee under 37 CFR § 1.17. Should there exist a variance between that which is paid and owed, the Office is authorized to charge deposit account number 15-0030, in order to maintain pendency of the above-identified application.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon



Daniel R. Evans, Ph.D.
Registration No. 55,868

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)